



**75TH
MORSS**

US Naval Academy
Annapolis, Maryland
June 12-13-14 2007
Through Multiple Disciplines, Analytical Power

712CD

75TH MORSS CD Cover Page

If you would like your presentation included in the 75th MORSS Final Report CD it must :

1. *Be unclassified, approved for public release, distribution unlimited, and is exempt from U.S. export licensing and other export approvals including the International Traffic in Arms Regulations (22CFR120 et seq.);*
2. Include MORS Form 712CD as the first page of the presentation;
3. Have an approved MORS form 712 A/B and
4. Be turned into the MORS office no later than: **DEADLINE: 14 June 2007 (Late submissions will not be included.)**

Author Request (To be completed by applicant) - The following author(s) request authority to disclose the following presentation in the MORSS Final Report, for inclusion on the MORSS CD and/or posting on the MORS web site.

Name of Principal Author and all other author(s):

Richard Shirkey

Principal Author's Organization and address:

Attn: AMSRD-ARL-CI-ED

WSMR, NM 88002-5501

Phone: (505) 678-5470

Fax: (505) 678-4449

Email: rshirkey@arl.army.mil

Please use the same title listed on the 75th MORSS Disclosure Form 712 A/B. If the title of the presentation has changed please list both.)

Original title on 712 A/B: Quantifying IWEDA Rules: How Red is Red?

If the title was revised please list the original title above and the revised title here:

PRESENTED IN: Military Environmental Factors

WORKING GROUP: 10

COMPOSITE GROUP:

SPECIAL SESSION 1:

SPECIAL SESSION 2:

SPECIAL SESSION 3:

DEMONSTRATION:

POSTER:

TUTORIAL:

OTHER:

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 01 JUL 2007		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Quantifying IWEDA Rules: How Red is Red?				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ARL Attn: AMSRD-ARL-CI-ED WSMR,NM 88002-5501				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM202526. Military Operations Research Society Symposium (75th) Held in Annapolis, Maryland on June 12-14, 2007, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 16	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Computational and Information Sciences Directorate

Battlefield Environment Division

Quantifying IWEDA Rules: How **Red** is **Red**?

Dr Richard Shirkey
Army Research Laboratory
Battlefield Environment Division
WSMR NM

Ph: (505) 678-5470
rshirkey@arl.army.mil



What is IWEDA

**IWEDA stands for the Integrated Weather
Effects Decision Aid**

It is a collection of system rules with associated critical values for aiding the commander select an appropriate platform, system or sensor under given weather conditions

Results are displayed via a red/amber/green color matrix overlaid on a background map



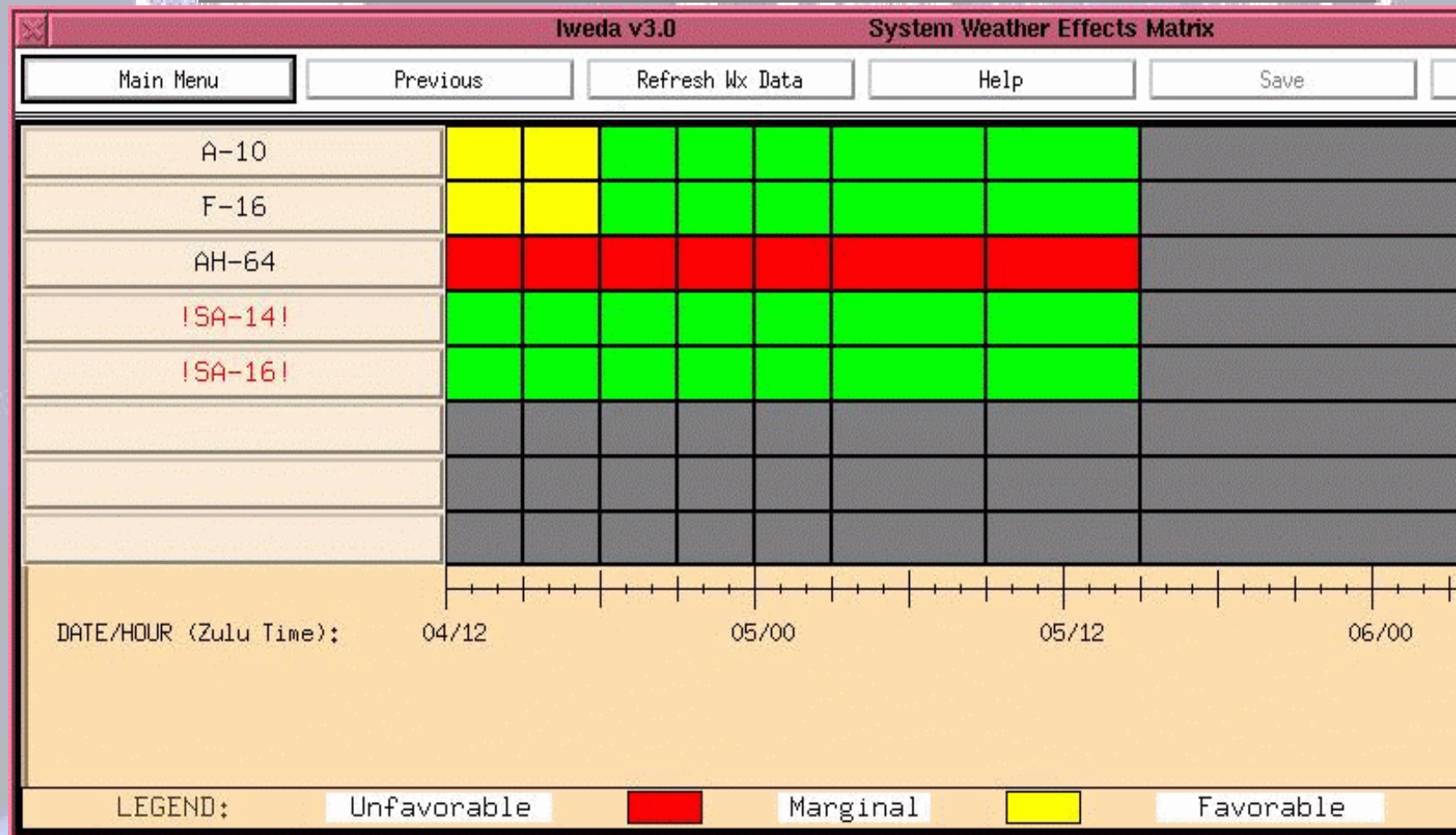
Integrated Weather Effects Decision Aids (IWEDA)



Computational and Information Sciences Directorate

Battlefield Environment Division

**Time Dependent - IWEDA Impact Matrix - One Row for each system
showing time dependent impact over entire domain**





Rule Based TDA - Integrated Weather Effects Decision Aid



Computational and Information Sciences Directorate

Battlefield Environment Division

lweda v3.4

EXPLAIN: [TFXXI]/*M1/*LASER RANGEFINDER ND:YAG

Main Menu

Previous

Refresh Wx Data

Help

Save

Exit

DATE/TIME: 16/12

COMPONENT(S) FOR *LASER RANGEFINDER ND:YAG

LASER R/D

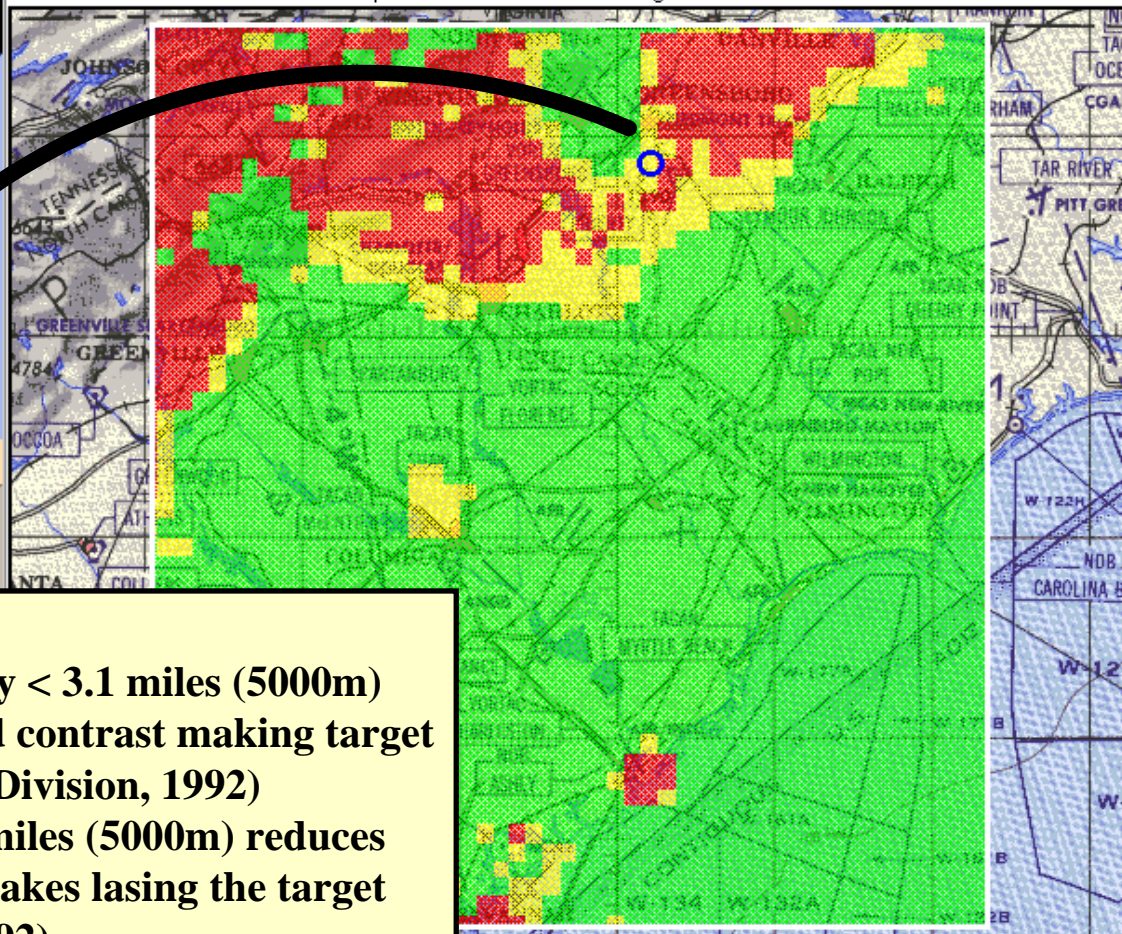
Component -> LASER R/D Day/Hr -> 16/12

CLICK COLORED CELL(S) ABOVE, THEN MAP FULL IMPACTS:

LASER R/D: MARGINAL

Any occurrence of fog and visibility < 3.1 miles (5000 m) reduces the target and background contrast making target acquisition difficult. (1st Cavalry Division, 1992)

LASER R/D: MARGINAL
Any occurrence of fog and visibility < 3.1 miles (5000m) reduces the target and background contrast making target acquisition difficult. (1st Cavalry Division, 1992)
Any occurrence of visibility < 3.1 miles (5000m) reduces the range and reflectiveness and makes lasing the target difficult. (1st Cavalry Division, 1992)



Cursor:35,398,-81,810



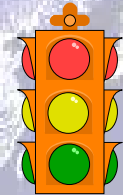
IWEDA RULES: HOW RED IS RED?



Computational and Information Sciences Directorate

Battlefield Environment Division

- IWEDA rules are implemented in terms of stop light charts
 - Red-Yellow-Green
 - Boundaries are 70% (R/Y) and 30% (Y/G) reduction in effectiveness
- Reality dictates boundaries should be fuzzy
- Simulations have *repeatedly* asked for numbers
- Initial study shows feasibility
 - limited number of cases
 - may not be possible for all rules





IWEDA RULES: HOW RED IS RED?



Computational and Information Sciences Directorate

Battlefield Environment Division

First Case: Helicopter Accidents Related to Wind

- **NTSB data used**
 - on-demand Part 135*
 - multiple causes and factors for accidents are cited resulting in a sum greater than the total number of accidents
- **Assumption**
 - Weather related accidents are equal for military and civilian craft
- **Blade number not considered**

*aircraft with a maximum seating capacity of 9 passengers in piston-engine airplanes, 30 passengers in turbo-prop or jet airplanes, and 12 passengers in helicopters.



Initiating Event for an Accident Flight

(on-demand Part 135 2002)



Computational and Information Sciences Directorate

Battlefield Environment Division

Factors underlying Airplane Accidents

Loss of Control - In-flight	6
Overrun	4
Airframe Component or System Failure	3
In-flight Collision with Object	3
In-flight Collision with Terrain or Water	3
In-flight Encounter with Weather	3
On Surface Collision with Terrain or Water	3
Collision between Aircraft (Not Midair)	2
Loss of Control – Surface	2
Loss of Engine Power (Total) Nonmechanical	2
Midair Collision	2
On Surface Collision with Object	2
Gear Collapsed	1
Loss of Engine Power	1
Loss of Engine Power (Partial) Nonmechanical	1
Main Gear Collapsed	1
Miscellaneous/Other	1
Undershoot	1
Total	41

Factors underlying Helicopter Accidents

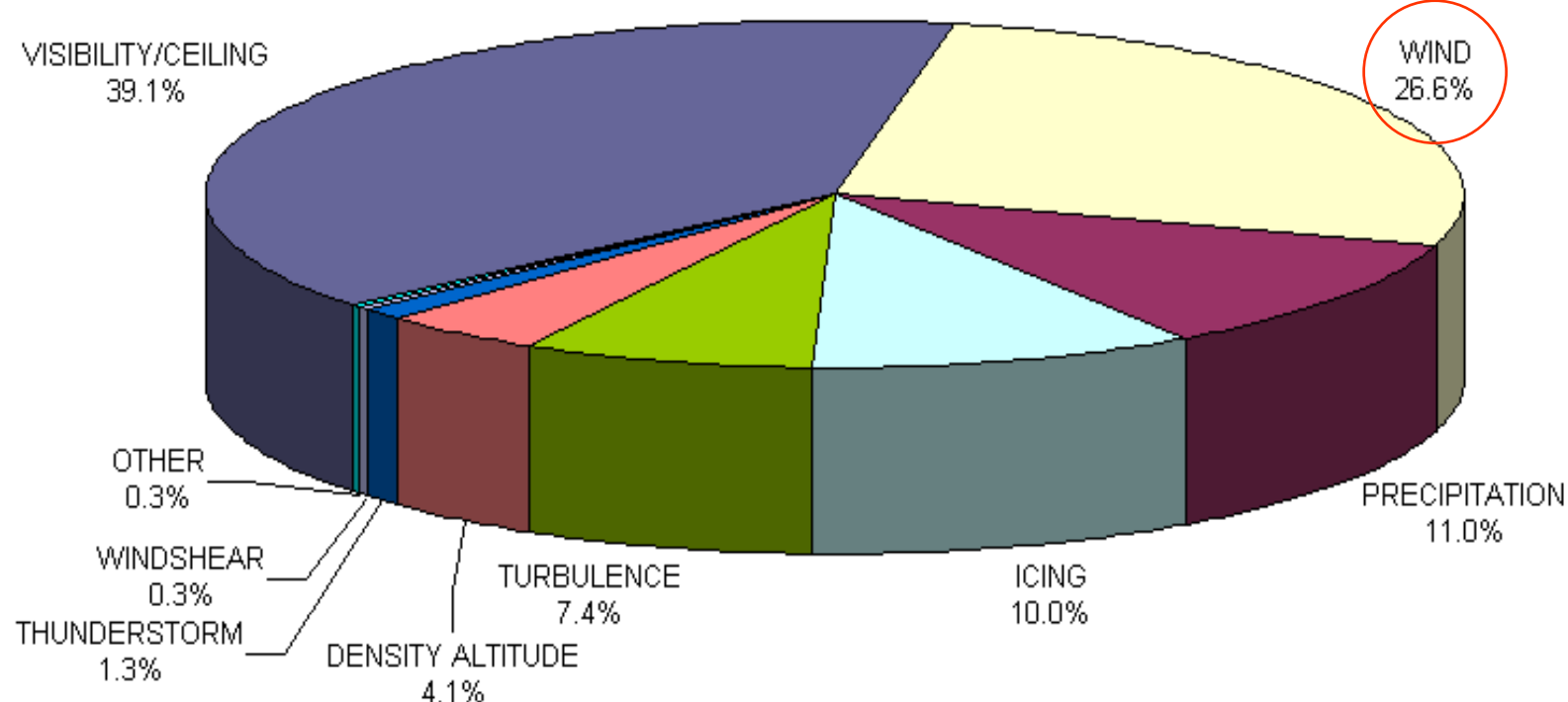
Loss of Control - In-flight	4
In-flight Collision with Object	2
In-flight Collision with Terrain or Water	2
In-flight Encounter with Weather	2
Airframe, Component, or System Failure	1
Fire	1
Loss of Control – On Ground/Water	1
Loss of Engine Power (Total) Mechanical	1
Roll Over	1
Total	15

40% of Weather-related Accidents occur to Helicopters

Part 135 accidents decreased from a peak in 1996, with 2002 showing a 17% decrease from 2001

PART 135 NTSB WEATHER RELATED ACCIDENTS BY WEATHER CONDITION 1994-2003

831 PART 135 ACCIDENTS



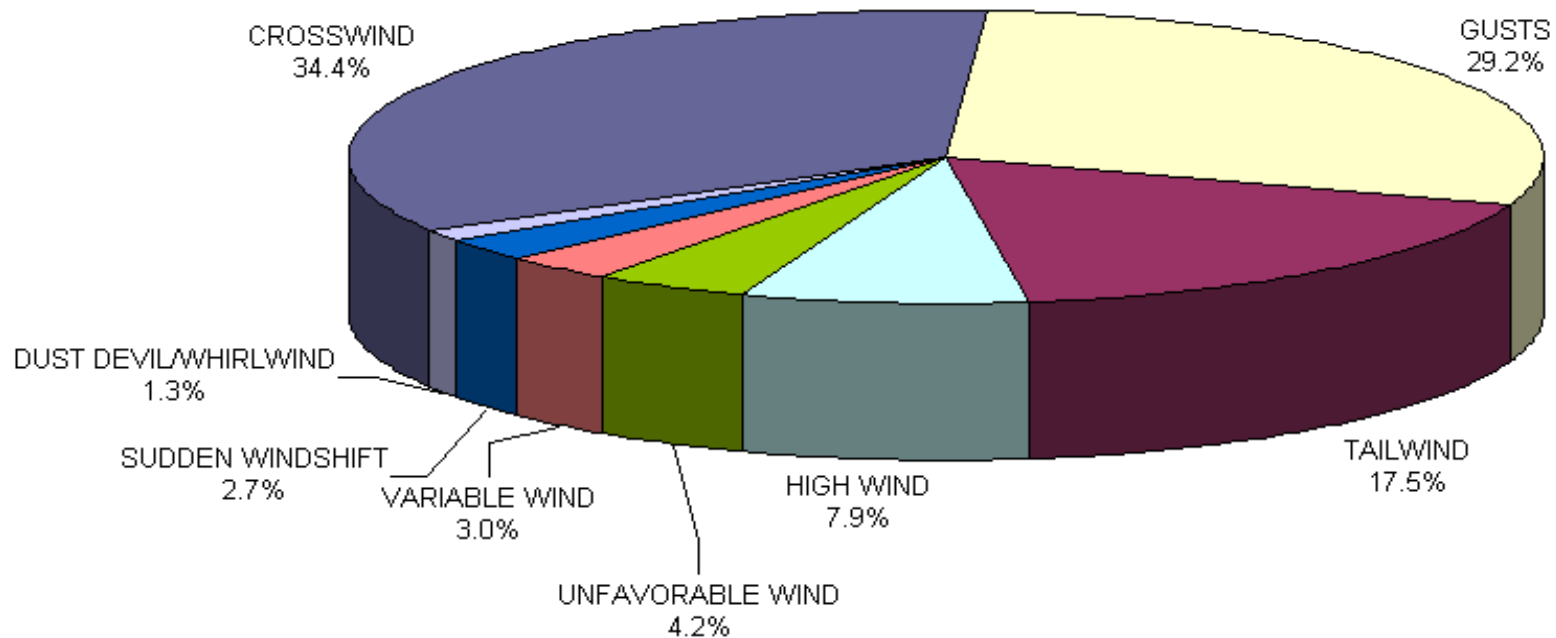
Between 1994 and 2003, there were 19,562† aircraft accidents, involving 19,823 aircraft, of which 831 were conducted under FAR Part 135. Weather was a contributing cause or factor in 257 of the Part 135 accidents. This chart identifies the breakout of Part 135 weather related accidents according to the weather condition(s) involved in the event.

† Accidents include final reports only where causal factors were identified.

§ A single accident may involve multiple weather conditions.

DISTRIBUTION OF WIND CONDITIONS IN NTSB WEATHER RELATED ACCIDENTS 1994-2003

4,159 WEATHER RELATED ACCIDENTS



Between 1994 and 2003, there were 19,562† aircraft accidents, involving 19,823 aircraft. Weather was a contributing factor in 4,159 of these accidents and involved 4,167 aircraft. Of the 4,159 weather related accidents, a wind condition was cited as a contributing cause or factor 2,726 times. This chart identifies the breakout of the wind conditions.

† Accidents include final reports only where causal factors were identified.

§ A single accident may involve multiple weather conditions.



Helicopter Accidents Related to Wind



Computational and Information Sciences Directorate

Battlefield Environment Division

- **NTSB data**
 - **40% of the weather related accidents occurred to helicopters**
 - **30.9% of all accidents were weather related**
 - **26.6% of all weather related accidents were due to wind**
- **3.3% of helicopter accidents are due to wind**

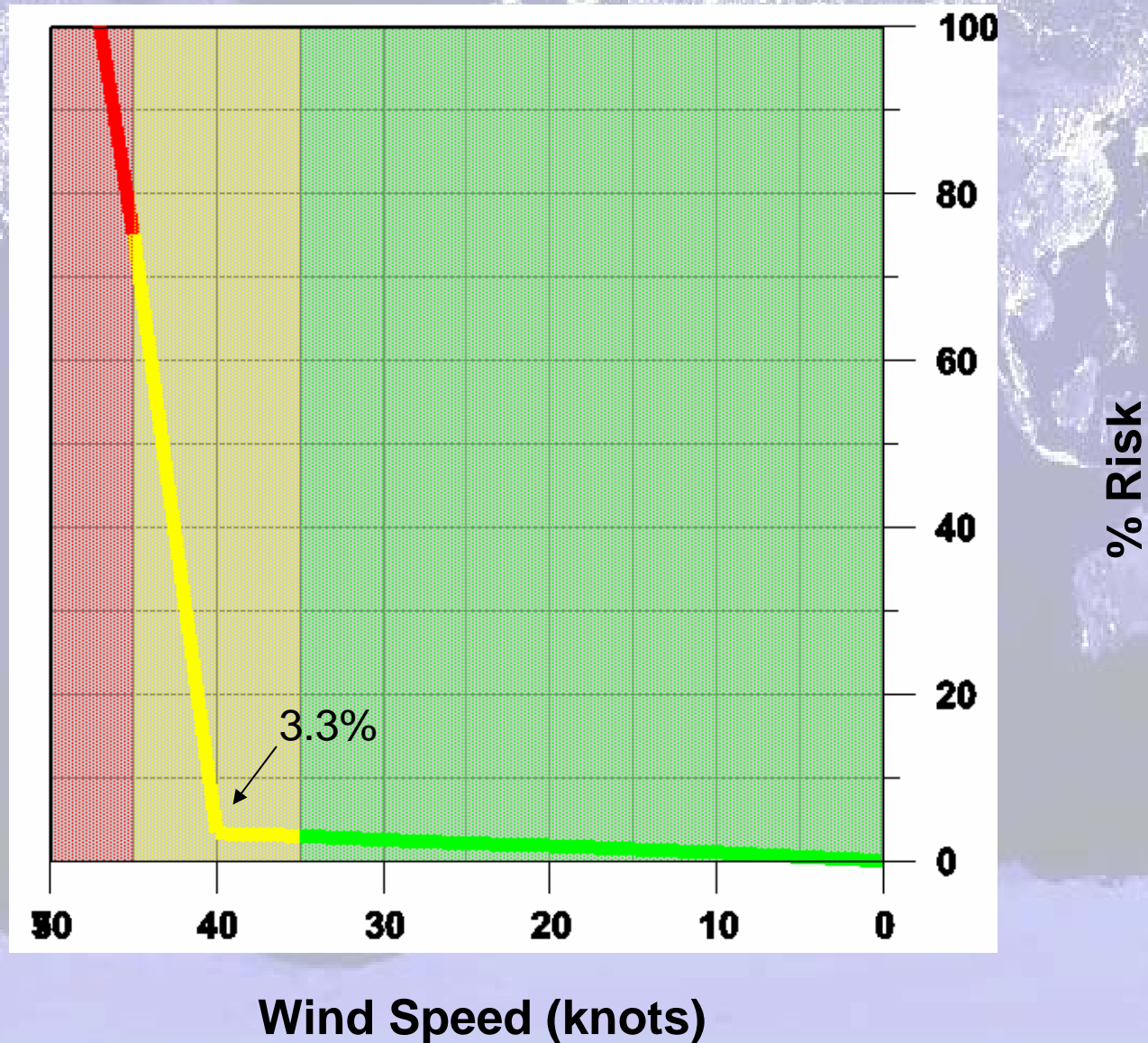


Helicopter Risk Assessment



Computational and Information Sciences Directorate

Battlefield Environment Division



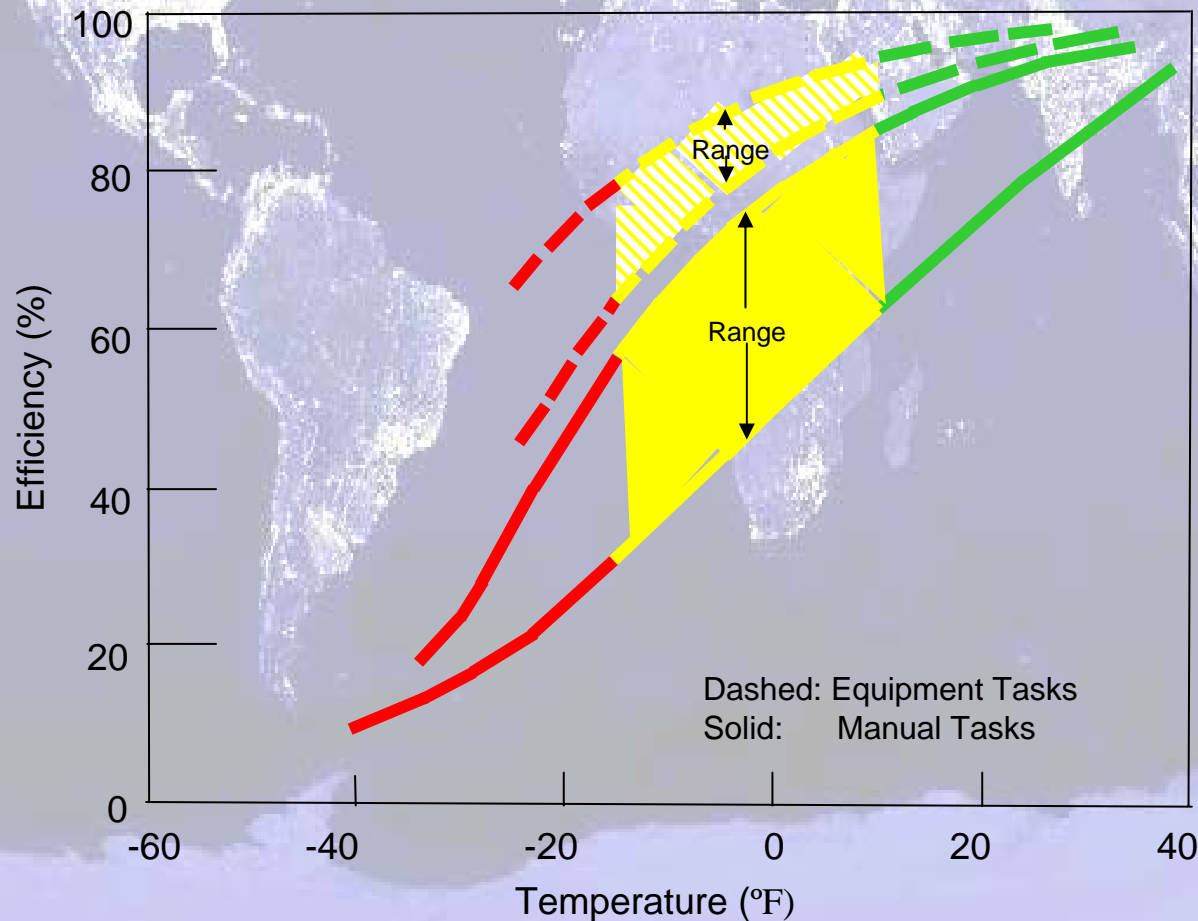


IWEDA RULES: HOW RED IS RED?

Computational and Information Sciences Directorate

Battlefield Environment Division

Second Case: Effect of temperature on Army personnel manual and equipment tasks



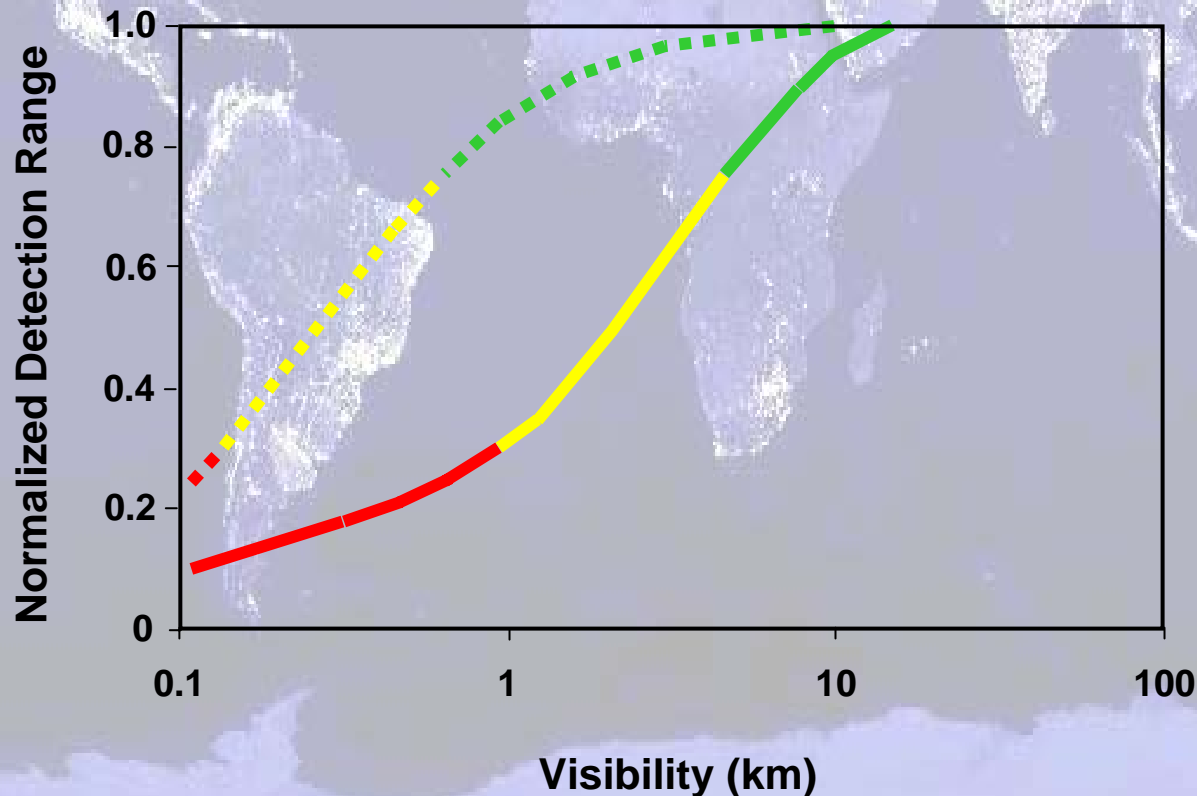


IWEDA RULES: HOW RED IS RED?

Computational and Information Sciences Directorate

Battlefield Environment Division

Third Case: Effects of different aerosol types on detection range for an average FLIR at 1500



Dashed: Rural (cloudless & overcast)

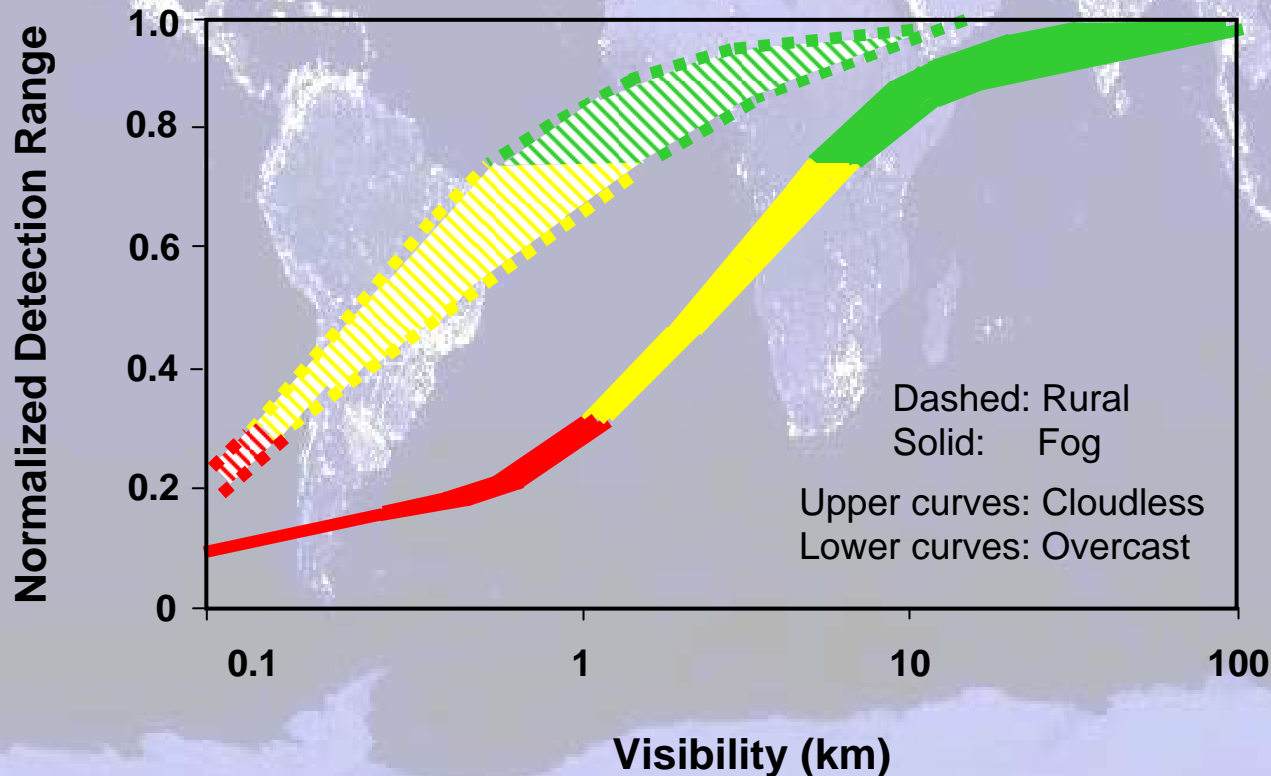


IWEDA RULES: HOW RED IS RED?

Computational and Information Sciences Directorate

Battlefield Environment Division

Third Case: Effects of different aerosol types on detection range for an average FLIR at 0900





Computational and Information Sciences Directorate

Battlefield Environment Division

?